UNITED STATES PATENT AND TRADEMARK OFFICE

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10/563,926	01/09/2006	Paulus Wilhelmlus Gruijters	NL030817	3785

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ART UNIT	PAPER NUMBER
4133	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ip.department.us@nxp.com

	Application No.	Applicant(s)
Office Action Summary	10/563,926	GRUIJTERS ET AL.
	Examiner	Art Unit
	EBONI GILES	4133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>09 January 2006</u>.
2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-13</u> is/are pending in the application.
    4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) <u>1-13</u> is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on <u>09 January 2006</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☒ All   b)☐ Some * c)☐ None of:
      1.☒ Certified copies of the priority documents have been received.
      2.☐ Certified copies of the priority documents have been received in Application No. _____ .
      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date <u>1/9/06</u>.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____ .

DETAILED ACTION

Priority

1.   Acknowledgment is made of applicant's claim for foreign priority under 35

U.S.C. 119(a)-(d). The certified copy of European Patent No. 03102122.3, filed on July

11, 2003, has been received in this National Stage Application PCT/IB04/051133, filed

on July 6, 2004, from the International Bureau.

Information Disclosure Statement

2.   The information disclosure statement (IDS) PTO-1449 submitted on 1/9/06 was

filed before the mailing date of the non-final office action. The submission is in

compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure

statement is being considered by the examiner.

Claim Rejections - 35 USC § 102

3.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4.   Claims 1, 10-13 are rejected under 35 U.S.C. 102(b) as being anticipated by WO

00/77961 to Kim.

        Kim teaches "a receiver for receiving frequency signals comprising a

processing stage for converting the frequency signals into baseband signals

comprising preamble symbols and data symbols and for processing the

baseband signals" where an apparatus for achieving frequency and symbol

timing synchronization of OFDM signals…The apparatus receives an OFDM

signal. The OFDM signal is made up of preamble data and payload data. The

preamble data include an AGC symbol and a synchronizing symbol (pg. 6, lines

2-5).

Kim further discloses "a synchronization stage for synchronizing the

processing stage comprising a first part for performing a coarse time

synchronization through auto-correlating samples of a group of preamble

symbols," where the auto-correlation unit receives data including a synchronizing

symbol made up of at least three identical synchronizing signals, delays the

received data by a pre-determined delay amount, performs auto-correlation

between the received data and the delayed data, normalizes an auto-correlated

value. The peak flat detector detects as a flat section a section where the

normalized auto-correlated value is equal to or greater than the threshold value

(pg. 3, lines 6-14). The three identical synchronizing signals read on a group of

preamble symbols which individually comprise the same sixteen samples, as

stated in the disclosure. The peak flat detector of the cited art is analogous to

the integrating unit for performing envelope detection as stated in the disclosure.

The normalization of the auto-correlated value is analogous to the scaling

function performed as stated in the disclosure. The auto-correlation between the

received data and the delayed data reads on the deciding unit for comparing the

envelope [flat detection] with the delayed and up-scaled version of itself as stated

in the disclosure;

Kim further discloses "a second part for performing a fine time synchronization through cross-correlating samples of a further group of preamble symbols with predefined samples," where the cross correlation unit performs cross correlation using a frequency offset-compensated signal and a reference signal, and normalizes the cross-correlated value to output a normalized cross-correlated value. The symbol timing synchronization unit detects a point where the cross-correlated value is maximum, and performs symbol timing estimation, thereby performing symbol timing synchronization (pg. 3, lines 17-22).

Claims 10 and 13 have limitations similar to those treated in the above rejection of Claim 1, and are met by the references as discussed above.

Process claim 11 is drawn to the apparatus corresponding to the method of using same as claimed in claim 1. Therefore, apparatus claim 1 corresponds to process claim 1 and is rejected for the same reasons of anticipation as used above.

Method claim 12 is drawn to the method of using the corresponding apparatus claimed in claim 1. Therefore, method claim 12 corresponds to apparatus claim 1 and is rejected for the same reasons of obviousness as used above.

Claim Rejections - 35 USC § 103

5.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6.   Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 00/77961 to Kim as applied to Claim 1 above and in further view of European Patent Application 1,071,251 to Mizoguchi et al. ("Mizoguchi").

Regarding Claim 2, Kim and disclose a receiver for receiving frequency signals comprising a processing and synchronization stage as recited in Claim 1.

Kim does not expressly disclose a synchronization stage that comprises a third part for performing a coarse frequency synchronization through detecting and accumulating phases of samples of a yet further group of preamble symbols.

Mizoguchi does expressly teach "a synchronization stage that comprises a third part for performing a coarse frequency synchronization through detecting and accumulating phases of samples of a yet further group of preamble symbols," where a frequency offset compensation circuit recognizes repetition signals in a received signal, or a preamble for synchronization, so that it measures carrier frequency offset between a transmit side and a receiver side by measuring a phase rotation between repetition waveforms, and compensates said carrier frequency offset (¶ 0011). Measuring the phase rotation detects and accumulates phases of each detected OFDM sub-carrier signal or sample. Mizoguchi further teaches that a preamble for synchronization comprises a plurality of repetitive known data patterns called a short interval (10 short intervals t1 through t10 provided) (¶ 0005, Fig. 11A);

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the receiver of Kim with the coarse frequency synchronization part of Mizoguchi. The suggestion/motivation would have been in order to synchronize receiver carrier frequency with transmitter carrier frequency (Mizoguchi, ¶ 0006).

Regarding Claim 3, Kim and Mizoguchi disclose a receiver for performing coarse frequency synchronization as recited in Claim 2.

Kim does not expressly disclose a further group of preamble symbols is situated between the group of preamble symbols and the further group of preamble symbols.

Mizoguchi does expressly disclose "a further group of preamble symbols is situated between the group of preamble symbols and the further group of preamble symbols," where said frequency offset compensation means comprises means for compensating carrier frequency offset between a repetition period of a short preamble between a transmit side and a receiver side upon each receipt of said short preamble (¶ 0028). Mizoguchi further teaches that a preamble for synchronization comprises a plurality of repetitive known data patterns called a short interval (10 short intervals t1 through t10 provided) (¶ 0005, Fig. 11A) and that the OFDM packet communication receiver receives at least a preamble for synchronization having a plurality of repetitive know short preambles followed by at least one OFDM signal having a guard interval (¶ 0020).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the receiver of Kim with a further group of preamble symbols of Mizoguchi. The suggestion/motivation would have been in order to accomplish independent synchronization of each received packet, including determination of reference timing of a received symbol (Mizoguchi, ¶ 0003).

7.   Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 00/77961 to Kim in view of European Patent Application 1,071,251 to Mizoguchi et al. ("Mizoguchi") as applied to Claims 2 and 3 above and in further view of U.S. Patent 6,754,170 to Ward.

As to Claim 4, Kim and Mizoguchi disclose a receiver for performing coarse frequency synchronization comprising a further group of preamble symbols as recited in Claim 3.

Kim and Mizoguchi do not expressly disclose that the third part is adapted to perform fine frequency synchronization.

Ward does expressly teach that "the third part is adapted to perform a fine frequency synchronization through detecting and accumulating phases of samples of another group of preamble symbols following the further group of preamble symbols," where the short symbols [i.e. preamble symbols t1-t10] are used to train the receiver's automatic gain control (AGC) and obtain a coarse estimate of the carrier frequency and the channel. The long symbols are used to fine-tune the frequency and channel estimates. Twelve subcarriers are used for the short symbols and fifty two subcarriers for the long symbols. The training of

an OFDM receiver is typically accomplished over several of the short symbols

and typically not less than the duration of two short symbols (Col. 8, lines 42-45)

therefore the further group of preamble symbols which constitute training

symbols are characterized with reference to this citation as long symbols. Fine

frequency synchronization is accomplished in a similar manner as coarse

frequency synchronization as described in the rejection of Claim 2 rather it relies

upon incrementally determining the carrier frequency offset over several sample

periods.

It would have been obvious to one of ordinary skill in the art at the time of

the invention to modify the receiver of Kim with a third part for performing fine

frequency synchronization of Ward. The suggestion/motivation would have been

in order to acquire the incoming signal and train and synchronize the receiver

(Ward, Col. 8, lines 34-35).

As to Claim 5, Kim and Mizoguchi disclose a receiver for performing

coarse frequency synchronization as recited in Claim 2.

Kim and Mizoguchi do not expressly disclose that the processing stage

comprises a fourth part for performing an automatic gain control after the coarse

time synchronization and before the coarse frequency synchronization.

Ward does expressly teach that "the processing stage comprises a fourth

part for performing an automatic gain control after the coarse time

synchronization and before the coarse frequency synchronization," where the

short symbols [i.e. preamble symbols t1-t10] are used to train the receiver's

automatic gain control (AGC) and obtain a coarse estimate of the carrier

frequency and the channel (Col. 8, lines 42-43) and further discloses that during

the first short symbol, automatic gain control is performed by the AGC (Col. 11,

lines 38-39, Fig. 4). The coarse time synchronization as stated in the disclosure

is performed within the first group of short symbols, t1-t3, therefore the AGC

processes the signal based on that first group to result in a coarse frequency

estimate. The coarse frequency is further processed and synchronized during

the next group of short symbols, t4-t7.

It would have been obvious to one of ordinary skill in the art at the time of

the invention to modify the receiver of Kim with a fourth part for performing an

automatic gain control of Ward. The suggestion/motivation would have been in

order to perform synchronization functions within the period of a few short

symbols, especially in the event of bad channel selection (Ward, Col. 4, lines 38-

41).

8.   Claims 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over

WO 00/77961 to Kim as applied to Claim 1 above and in further view of U.S. Patent

6,754,170 to Ward.

Regarding Claim 6, Kim and disclose a receiver for receiving frequency

signals comprising a processing and synchronization stage as recited in Claim 1.

Kim and do not expressly disclose a processing stage comprising a

mixing unit, transformating unit, buffering unit and controlling unit.

Ward does expressly disclose "a mixing unit for converting the frequency signals into the baseband signals," where an incoming OFDM signal is input to an analog-to-digital converter (A/D)...The sampled signal...is also applied to an I/Q sequencer for non-coherently converting the real intermediate A/D frequency samples into I and Q signals having baseband and other frequency components. (Col. 9, lines 56-66, Fig. 4, elements 201, 202, 202') which reads on the mixing unit as stated in the disclosure since it comprises an ADC and an I/Q sequencer which is analogous to a digital mixer for converting the signals to baseband;

Ward further discloses "a transformating unit coupled to an output of the mixing unit for processing the baseband signals," where the I and Q signals are passed through low pass filters (LPF) for removing unwanted frequencies and forming a continuous baseband output signal of baseband I/Q channels at a 20 MHz rate...a fast Fourier transform (FFT) circuit which performs a fast Fourier transform on the incoming signal at 16 or 64 complex point processing at a burst processing rate of 40 MHz (Col. 9, lines 64-67 & Col. 10, lines 12-14, Fig. 4, elements 203, 204, 211) which reads on the transformating unit as stated in the disclosure since it comprises an FFT and a LPF which performs an equalization function for processing baseband signals;

Ward further discloses "a synchronization stage comprising a buffering unit coupled to the output of the mixing unit for buffering at least a part of the baseband signals," where a buffering circuit holds the short, medium and long symbols of the preamble of the OFDM received signal (Col. 10, lines 3-5, Fig. 4,

element 206) where the converted signal output from the mixing unit comprises

symbols which are a baseband version of the OFDM received signal;

Ward further discloses "a controlling unit coupled to control inputs of the

mixing unit and the transformating unit for controlling the mixing unit and the

transformating unit," where the sampled signal is applied to an automatic gain

controller (AGC) 202 which supplies iterative feedback to an RF circuit for gain

control, and is also applied to an I/Q sequencer 202' for non-coherently

converting the real intermediate A/D frequency samples into I and Q signals

having baseband and other frequency components (Col. 9, lines 58-64, Fig. 4,

element 202) where the AGC (automatic gain control) circuit controls the

amplitude of the OFDM signal that will be supplied to the mixing unit (i.e. ADC)

and transformating unit (i.e. FFT and LPF);

Ward further discloses that the "inputs of the first part and the second part

being coupled to an output of the buffering unit and with an output of the first part

being coupled to a first input of the controlling unit and with an output of the

second part being coupled to a second input of the controlling unit," where

another output of the constellation processing circuit is applied to a timing

synchronizer circuit in accordance with this invention which acquires the OFDM

boundaries of the short and long symbols and provides a fractional bin timing

pulse (Col. 10, lines 24-28, Fig. 4, elements 213, 214, 216) reading on the

claimed second part (i.e. cross-correlation unit) for fine time synchronization, as

disclosed by Kim in the rejection of Claim 1, since the fractional part of the timing

pulse represents fine tuning of the signal. Ward further discloses that the timing synchronizer of this invention has another output connected to the buffer for adjusting the timing prior to reaching the FFT circuit. This is an integer sample timing correction (Col. 10, lines 40-43, Fig. 4, elements 206, 211, 216) reading on the claimed first part (i.e. auto-correlation unit) for coarse time synchronization, as disclosed by Kim in the rejection of Claim 1, since the integer part represents whole sample offsets. The buffering unit stores the preamble signals necessary to perform fine and coarse timing synchronization.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the receiver of Kim with a processing stage of Ward. The suggestion/motivation would have been in order to acquire the incoming signal and train and synchronize the receiver (Ward, Col. 8, lines 34-35).

As to Claim 9, Kim and Ward disclose a receiver for receiving frequency signals comprising a processing and synchronization stage as recited in Claim 6.

Ward does not expressly disclose a second part that comprises a cross-correlating unit, an absolute value unit, an integrating unit, a scaling unit and a deciding unit.

Kim does expressly teach a second part for performing fine time synchronization, where the reference signal generator generates and outputs a reference signal, and the complex conjugator complex-conjugates the reference signal. The multiplier multiplies the complex-conjugated reference signal by the frequency offset-compensated signal output from the frequency compensator,

and the moving average calculator calculates a moving average. That is, a cross correlated value is obtained by cross correlation performed by the multiplier and the moving average calculator. The normalizer normalizes the cross correlated value output from the moving average calculator. The cross correlation unit performs cross correlation using the frequency offset-compensated signal and the reference signal and normalizes a cross correlated value, thereby outputting a normalized cross correlated value. The symbol timing synchronization unit detects a point where the cross correlated value is maximum...where an error of about ± 16 samples is allowed (pg. 8, lines 1-21). The complex conjugator essentially performs the function of the claimed absolute value unit. The moving average calculator is analogous to the integrator as it determines a moving average of the frequency offset-compensated signal. The cross correlation uses values output from the moving average calculator. The normalizer is analogous to the scaling unit which receives values from the moving average calculator. The symbol synchronization unit comprises a deciding unit which detects the peaks of the cross correlation values.

9.   Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable WO 00/77961 to Kim in view of U.S. Patent 6,754,170 to Ward as applied to Claim 6 above and in further view of European Patent Application 1,071,251 to Mizoguchi.

        Regarding Claim 7, Kim and Ward disclose a receiver for receiving frequency signals comprising a processing and synchronization stage as recited in Claim 6.

Ward does not expressly disclose a first part that comprises an auto-correlating unit, integrating unit, first delaying unit, scaling unit, deciding unit, second delaying unit and logical units.

Kim does expressly teach that the auto-correlation unit receives data including a synchronizing symbol made up of at least three identical synchronizing signals, delays the received data by a pre-determined delay amount, performs auto-correlation between the received data and the delayed data, normalizes an auto-correlated value. The peak flat detector detects as a flat section a section where the normalized auto-correlated value is equal to or greater than the threshold value (pg. 3, lines 6-14). The peak flat detector of the cited art is analogous to the integrating unit for performing envelope detection as stated in the disclosure. The normalization of the auto-correlated value is performed by multiplying the envelope by a multiplication factor and is analogous to the scaling function performed as stated in the disclosure. The auto-correlation between the received data and the delayed data reads on the deciding unit for comparing the envelope [flat detection] with the delayed and upscaled version of itself as stated in the disclosure. The auto-correlator provides the data for the coarse time synchronization, i.e. first part. The received data is delayed prior to auto-correlation, once auto-correlation is performed a normalized or scaled value is produced. The peak flat detector, i.e. integrating unit contains a deciding unit used to determine whether the normalized value meets a threshold. It would be an obvious variation to integrate the values from

the auto-correlator prior to delaying the received signal and scaling the auto-correlated value. The integrator serves to perform envelope detection to smooth the signal after coarse time synchronization has been performed.

Kim does not expressly teach a second delaying unit or logical units.

Mizoguchi does expressly teach that a correlation output filter is applied to a threshold circuit through a delay circuit and an output of the delay circuit is further applied to another threshold circuit through another delay circuit (Col. 10, lines 34-37) reading on the claimed second delaying unit for delaying comparator signals (i.e. threshold circuit) as stated in the disclosure. Mizoguchi further teaches that the output of the threshold circuits are applied to a logic circuit which is implemented by an AND circuit (Col. 10, lines 57-58) reading on the claimed logical units for combining the comparator signals as stated in the disclosure. It would be an obvious variation to delay the auto-correlated value from the deciding unit taught by Kim since delaying the value would possibly eliminate a phase difference and thereby reduce coarse frequency error.

It would have been obvious at the time of invention to combine a second delaying unit and logical unit taught by Mizoguchi with a first part taught by Kim. The suggestion/motivation would have been in order to compensate carrier frequency offset in a receiver (Mizoguchi, ¶0016).

As to Claim 8, Kim, Mizoguchi and Ward disclose a receiver for receiving frequency signals comprising a first part for coarse time synchronization as recited in Claim 7.

Kim and Ward do not expressly disclose a third part for performing coarse and fine frequency synchronization comprising a phase detector and accumulator.

Ward does disclose that a time delay is derived at the output of the FFT circuit when multiplied by the complex exponential. The time delayed signal represented by the short symbols in the OFDM preamble can be used to estimate the time delay as a common phase rotation. This time estimate represents both the integer sample timing correction and the fractional sample timing correction (Col. 10, lines 63-67 & Col. 11, lines 1-2). The output of the FFT, a part within the auto-correlator, is representative of the first part of the receiver and the time estimate derives the coarse (i.e. integer sample timing) and fine frequency (i.e. fractional sample timing) synchronization.

Mizoguchi does expressly teach that an output of the hold circuit is applied to the phase compensation calculate circuit. An input to the phase compensation calculate circuit is phase rotation during repetition period of a short preamble caused by carrier frequency offset. By using the input signal, the phase compensation calculate circuit calculates the phase rotation for every sample of the OFDM signal, and generates opposite phase rotation through integration process for compensating the phase rotation of a received signal caused by carrier frequency offset. An output of the phase compensation calculate circuit is applied to the compensation circuit, which compensates phase rotation of a received signal according to an output of the phase compensation calculate

circuit, and provides a compensated signal which is free from the carrier

frequency offset (¶ 0075-0076). The phase compensation calculate circuit is

analogous to the claimed phase detecting circuit and the compensation circuit is

analogous to the claimed phase accumulating circuit. The phase compensation

calculate circuit is coupled to the buffer which is part of the auto-correlating circuit

as stated in the disclosure. The compensated signal from the compensation

circuit is provided to the controlling unit in order to eliminate the carrier frequency

offset. In addition, the same motivation is used as in the rejection of Claim 7.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to EBONI GILES whose telephone number is (571)270-

7453. The examiner can normally be reached on Monday through Friday 7:30 AM to

5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Abul Azad can be reached on (571) 272-7599. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

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USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/EBONI GILES/   /ABUL AZAD/
Examiner, Art Unit 4133   Supervisory Patent Examiner, Art
                                                       Unit 4133